

The topography and demographic composition of West Virginia creates a great opportunity and need for a more advanced and integrated telehealth network. Some of the health system needs to be addressed by this network include:

- The terrain is rugged, and average travel time to medical services is higher than that of nearby states. Only half of the roads are paved and more than 60% of the paved highways are rated fair, poor, or very poor for cross-section (width of lanes and shoulders and number of lanes) or alignment (grades and curves). National studies confirm that poor road conditions are associated with longer driving times to reach medical care.
- Access to care is a challenge in rural areas. Only five West Virginia counties have an urban transportation system, while 17 have a rural transportation system. Four counties have a network of transportation services provided by social services. Thirty-one counties in West Virginia have limited or no public transportation systems at all.
- Physician-diagnosed chronic conditions are more prevalent among rural populations; nearly half (46.7%) of the adult rural population have one or more chronic condition(s) compared with 39.2% in urban areas. This finding in the State Health Plan is consistent with a study by the Agency for Health Care Policy and Research that found “almost one in three adults living in rural America is in poor to fair health. Nearly half have at least one major chronic illness. Yet, rural residents average fewer physician contacts per year than those in urban communities.” (<http://www.ahrq.gov/research/rural.htm>)
- Rural populations have lower levels of private health insurance; according to a study in 1996, only about 54% of rural residents had private health insurance compared with about 63% of urban residents. Seventeen percent of West Virginia residents lack any health insurance (Kaiser, 2003-2004).
- Fewer West Virginian adults reported having routine physical exams within the past two years than the U.S. average. Only a third of the state's adults with an annual family income under \$15,000 visited a dentist in the previous year. (Source: NCSL, Workforce Profile, West Virginia 2001)
- The shortage of physicians in West Virginia's sparsely populated rural areas is severe. The state ranks about 30th nationally in the ratio of physicians to population, and there are unfulfilled requests for more than 120 primary care physicians to meet needs in underserved rural areas. There are a disproportionately low number of physician specialists in rural areas; only about 10% of medical specialists practice in rural areas, compared with about 25% of family and general practice physicians. (State Health Plan) West Virginia has fewer physicians, nurse practitioners, dentists and dental hygienists per 100,000 population than the U.S. average, but more physician

assistants, licensed practical nurses and pharmacists per 100,000 population. (NCSL Workforce Profile, West Virginia 2001)

- There were nearly 82,000 people employed in the health sector in West Virginia in 2000, 11.9% of West Virginia's total workforce, compared to the national rate of 8.8%. West Virginia ranked 1st among states in percent of employment in health services.
- Health services employment in West Virginia grew 41% between 1988 and 2000, while the state's population declined by 1% during that period, resulting in a net per capita growth of 43% in health services sector employment, higher than the national rate of growth (21%).
- The total population of West Virginia is projected to grow 2% between 2000 and 2020, while the population 65 and over of the state is projected to grow 49% between 2000 and 2020.
- Caring for patients with diabetes is a significant public health challenge due to the distribution of health care resources. Because of the critical role of self-management, certified diabetes educators (CDEs), licensed professionals with advanced certification in diabetes care and patient education, serve an essential need in the health and well-being of the state's population with diabetes. In 2001, 79 certified diabetes educators were located in the state. The vast majority of the CDEs continue to practice in urban hospital or academic settings. The fact that West Virginia has an older, less educated, rural population, with fewer financial resources than the nation as a whole, poses additional challenges in the struggle against the disease's devastating effects. (Source: The Burden of Diabetes, West Virginia Diabetes Control Program)
- There were 5,783 hospitalizations of West Virginia residents in West Virginia hospitals in 2001 that were due to stroke; women accounted for 62% of these. West Virginia's overall rate of 32.1 hospitalizations per 10,000 population in 2001 was higher than the national rate of 27.1. Total charges for in-patient hospitalizations for stroke have increased steadily since 1997, from \$35 million in that year to \$49 million in 2001.
- As of 2001, West Virginia had 55 licensed neurologists and 29 neurosurgeons providing patient care in the state. The majority of doctors with a specialty in neurology or neurosurgery are currently located in the southern and northern regions of the state, with limited access in the middle, more rural counties. There is great need to connect these resources to rural practice settings to aid in the early diagnosis and treatment of stroke through a telestroke program. This program is in development through a pilot program involving 8 facilities linked electronically to WVU Health System.

The potential of telehealth applications to improve health and contain health care costs: Telehealth represents an expansion of the applications that have emerged from decades of using technology to overcome gaps in health care. Telemedicine—the delivery of medical care and services from a distance—is one of the oldest areas of this applied technology in medicine. The first high-profile appearance of telemedicine came in the 1960s when NASA used telemetry to monitor the health of astronauts during space missions. Since then telemedicine and telehealth applications have expanded to connect rural areas to specialty care, to permit distance learning applications for health care training and to connect health care professionals for consultations, including telestroke, telecardiology and teleradiology utilization.

A number of national experts have touted the benefits of telehealth in meeting many of the challenges faced by West Virginia. Many of these benefits, in health improvement and cost containment, have been validated by studies and research projects. These experts also expect that utilization of telehealth services will continue to expand as technology and connectivity improves, especially in many of our rural areas.

In 2005, Frost and Sullivan released the report *North American Emerging Telemedicine Markets*. Not including the medical devices or the telecommunication connections, the study determined that the telehealth/videoconferencing systems in the United States in the base year 2004 was \$52.8 million. Based on their research, Frost and Sullivan expected this market to expand at a compound annual growth rate of 10.2 percent from 2004 to 2008, resulting in a market value of \$77.9 million for telehealth/videoconferencing systems alone.

The home telehealth market in the United States was valued at \$140.8 million in 2004, the study's base year. Frost and Sullivan expected this market to expand by a compound annual growth rate of 24.2 percent from 2004 to 2008, resulting in a revenue value of \$335 million in 2008. The future for telehealth technology, and the effective utilization of this technology, is based on the consumer and the medical community's support for this method of delivering medical services. See: http://www.corp.att.com/healthcare/docs/article_telemedicine.pdf

According to the National Association for Home Care and Hospice, more than half of the 8,000 home care agencies in the U.S. that provide services to Medicare patients, already use some form of remote monitoring. Forrester Research predicts that by 2015, 12 percent of all seniors, 40 percent of all chronically ill, and 60 percent of all patients discharged after a lengthy hospital stay will be directed to these types of programs.

Geography is not the only factor that affects access to care. Insufficient capacity on the provider side can also prevent patients from obtaining care. Delays in care can further strain provider resources. Experts have predicted that the U.S. will

face a shortage of over 100,000 doctors and 800,000 nurses by 2020. Telemedicine can help expand capacity in two ways. First, the time and resources that telemedicine saves can free practitioners to see more patients in a given time period. Second, improved communication can enable providers to make more timely adjustments to care plans, which ultimately reduces the number of hospitalizations and subsequent office visits, thereby creating new capacity. Some experts predict that the use of telemedicine could increase office visit capacity by 30 percent for certain disease states. See: <http://www.fcq.com/research/serve-research.aspx?rid=335>

Potential implications **for West** Virginia: While this plan outlines a number of existing uses of telehealth in West Virginia, it does not appear that this technology is currently being employed to its fullest potential. Information from other states and other projects is instructive of the potential that an integrated telehealth system, as contemplated by this plan, could have for health improvement and cost-containment in the state.

A report by the Veteran's Administration concerning the outcome of its home health project was published in 2002 in *Disease Management*. The V.A. study found that by monitoring specific health conditions and coordinating the patient's care, it could reduce the number of emergency room visits by 40 percent, reduce hospital admissions by 63 percent and reduce the number of days in the hospital by 60 percent. It also reduced the number of nursing home admissions by 64 percent with a reduction in the number of days of care in a nursing home by 88 percent, all while seeing a significant improvement in the quality-of-life measurement. Other studies have validated these findings, and additional studies continue to validate the savings identified in the V.A. study.

A similar program has demonstrated that home monitoring programs for the elderly are effective in providing a cost-effective alternative to institutional care. Telemedicine can provide effective patient monitoring for a cost of approximately \$30 per day, less than half the cost per day of home care and one-third the cost per day for nursing care. The cost savings are most dramatic when compared to the \$820 per day cost for inpatient hospital care. Case studies have shown:

- A demonstration of telemedicine used in over 1,000 patient encounters in Tennessee showed significant savings. More than 62,000 miles of travel were saved by using telehealth. This translates into a savings of \$16,191 (62,274 miles at \$0.26/mile) in mileage that did not have to be reimbursed in the 39 months since the program began. Additionally, nurse driving time that did not have to be reimbursed totaled \$33,042 (97,181 minutes at \$0.34/minute). Overall this represented a savings of \$50.29 per home visit. Cost savings for the first 15 months of the program were \$49.33 per home visit. A greater the number of visits done through telehealth over time produces a greater cost savings per visit.

- Kaiser Permanente of Sacramento, Calif., conducted a study from May 1996 through November 1997. The study comprised intervention and control groups of one hundred patients each with chronic conditions. The control group continued to receive home-care visits according to their existing plan of care, while the intervention group was remotely monitored with a home telehealth system as a supplement to home-care visits. The data revealed that home telehealth provided instant access to care, created considerable efficiency in the delivery of home care and reduced hospitalization by two hundred days in the intervention group.

See: <http://www.americantelemed.org/news/mediaguide/hometelehealth.htm>

A study evaluated patients' cost savings in a telehealth project at the University of Arkansas for Medical Sciences' (UAMS) during 1998-2002. Differences in patients' cost savings from telemedicine were assessed by gender, age, ethnicity, education, occupation, annual household income, health insurance status, and household and community size. Variables examined for patients' cost savings included travel distance for medical care, missed days at work, and family expenses. The study population consisted of self-selected telemedicine patients in rural Arkansas ($N=410$ consults). Results suggest that without telemedicine, 94% of patients would travel greater than 70 miles for medical care; 84% would miss one day of work; and 74% would spend \$75-\$150 for additional family expenses. With telemedicine, 92% of patients saved \$32 in fuel costs; 84% saved \$100 in wages; and 74% saved \$75-\$150 in family expenses. Patients living alone ($p < 0.001$) and in smaller rural communities ($p = 0.002$) were significantly more likely to miss one day of work without telemedicine than patients with larger households and those residing in larger rural communities. See: *Telemedicine Journal and e-Health, The Impact of Telemedicine on Patients' Cost Savings: Some Preliminary Findings*, Dec 2003, Vol. 9, No. 4 : 361 -367

A project that demonstrates the potential impact on access to care in rural areas involves the University of Tennessee Health Science Center (UTHSC), in Memphis, that created a Telehealth Network and Outreach Center to improve access to specialty medical care for rural and disadvantaged populations in Tennessee, Mississippi and eastern Arkansas. Part of this project involved the creation of the Mid-Appalachia Telehealth Project (MATP), a partnership between UTHSC and several underserved mountain communities in East Tennessee focused on improving chronic disease management. As part of the MATP project:

- Diabetes patients in need of close monitoring were given home-based telehealth equipment to record and forward daily glucose readings and other vital statistics to nurses in local health departments and community health centers. Nurses conducted weekly telephone assessments with patients and proactively call them when monitoring data indicate that something is amiss. The nurses also contacted patients to offer preventive education, support adherence to treatment, adjust medications, and schedule appointments as needed. Videoconferencing capabilities (using

ordinary phone lines) enabled nurses to make visual contact and observations.

- Through a telehealth partnership with local schools and clinics, children with asthma were regularly monitored using peak flow meters available in the schools. Test results were electronically forwarded to local clinic nurses. The system flags readings that are out of normal range so that nurses can make changes in management as needed. Children attend weekly one-on-one educational sessions with a clinic nurse to review peak flow meter use and asthma management. Specialty pulmonary consultations are available when needed through the Telehealth Network.

The MATP project conducted nearly 2,000 in-home televisits with 117 adult diabetes patients since 2004. Among 42 diabetes patients who completed six months in the program, 71 percent had an improvement in blood sugar control (hemoglobin A1c level) and one-third achieved a decrease of 1 percent or greater. Among 53 participating school children with asthma, two-thirds showed an improvement in peak flow meter readings after being in the program for an average of six months.

Overall, more than 4,500 patients have been seen through the UTHSC Telehealth Network since 2003. The outcomes are:

- The time between patient referral and treatment is 39 percent shorter for telehealth patients compared with in-person visits.
- Overall waiting room times are almost 50 percent shorter for telehealth patients compared with traditional patients.
- The no-show rate for telehealth visits ranges from 0.7 to 4.8 percent, as compared with 42 to 46 percent for patients referred to UTHSC from outside Memphis.
- Patient throughput is higher for telehealth visits, averaging 3.76 patients per hour versus 2.25 patients per hour for traditional specialty visits.
- Patients rate telehealth visits highly: 96 percent said they were as good quality as regular office visit and 53 percent rated them as higher quality; 100 percent agreed that the specialist's attention was as good as a regular visit and 60 percent rated it better.

See: http://www.cmwf.org/tools/tools_show.htm?doc_id=468916

As an example of the potential benefit of this type of system for our children, Sentara Home Care Services has utilized a successful school-based telehealth program focused on better asthma control. Using a telehealth unit in the office of the school nurse, children with asthma have regularly scheduled appointments with the home care nurse through a two-way video monitor. Over the past two consecutive school years, the program has dramatically reduced missed school days by 61%, reduced ER visits by 70% and reduced hospital readmissions by 86% in a group of 19 middle school children with asthma.

Health Care Delivery in West Virginia

West Virginia's Health Care Delivery System: Despite its rural nature, West Virginia enjoys a network of hospitals, clinics and health care professionals. Since much of health care is driven by the volume of demand for services, many of these health care resources are clustered in urban areas. Access to care in most rural areas means significant drive times, especially to more advanced specialty care. One of the objectives of this project is to reduce these barriers to care through more effective coordination of telehealth resources.

Hospitals: There are 54 acute care community hospitals in West Virginia, 32 of which are located in rural areas (North Carolina Rural Health Research and Policy Analysis Center, 2006). The state has 18 hospitals currently identified by the Flex Monitoring Team as Critical Access Hospitals. There are also 63 Rural Health Clinics in West Virginia (Source: West Virginia Hospital Association).

West Virginia's tertiary hospitals: These hospitals provide medical education and the highest levels of specialty and trauma care. They will serve as the hub for the integrated telehealth system. :

Cabell Huntington Hospital is a 322 bed, not-for-profit, regional referral center located in Huntington, West Virginia. CHH cares for patients from more than 29 counties throughout West Virginia, Eastern Kentucky and Southern Ohio. CHH also operates as a teaching hospital affiliated with Marshall University Schools of Medicine and Nursing. The hospital is a Level II trauma center and provides neonatal and pediatric intensive care; burn intensive care; bariatric surgery; and comprehensive cancer care through the Edwards Cancer Center operated in conjunction with Marshall University School of Medicine.

Charleston Area Medical Center is the flagship of the CAMC Health System. The CAMC Health System serves a 12-county, largely rural, poor, underserved area in the southern part of WV where nearly one third of all West Virginians reside. CAMC is a non-profit, 893-bed, regional referral and academic medical center. CAMC has three Charleston locations: General Hospital, Memorial Hospital and Women and Children's Hospital. A branch of the Morgantown-based West Virginia University Robert C. Byrd Health Sciences Center has been a part of CAMC's Memorial Hospital campus since 1972. More than 100 third-and fourth-year WVU medical students and more than 100 CAMC residents, supervised by WVU faculty, continue their education in Charleston each year. CAMC also provides post graduate training in cooperation with the West Virginia School of Osteopathic Medicine and the Mountain State Osteopathic Postgraduate Training Institute for pediatrics, internal medicine and family medicine along with a rotating internship.

CAMC has one of the most advanced heart programs in the United States, one of two kidney transplant centers in the state (carried out in tandem with the

Cleveland Clinic) and a Level I Trauma Center. It operates the state's only accredited sleep disorders center. CAMC General Hospital is also home to behavioral medicine, psychiatry, physical therapy, occupational therapy, transitional care and orthopedics departments. CAMC Memorial Hospital is home to the nation's seventh largest cardiology programs. Memorial Hospital is also the site of the Cancer Center of Southern West Virginia and a related cancer patient support program; as well as the Heart Institute of West Virginia and a comprehensive Diabetes Center. The Women and Children's Hospital is home to the region's largest and busiest Level III neonatal intensive care unit and pediatric intensive care unit. Each year more than 3,200 babies are born here, many of which are high-risk births

The pediatric physicians of West Virginia University/Charleston Division provide specialty consultation in endocrinology, surgery, trauma and critical care. Charleston Division obstetrics and gynecology faculty provide high-tech maternal-fetal medicine and gynecologic cancer services.

Ohio Valley Medical Center, (OVMC) operates in West Virginia's Northern Panhandle and offers an array of primary and tertiary care services, from its EMSTAR emergency services and Level II trauma care through rehabilitation services, with more than 250 physicians on staff. OVMC and Peterson, along with their sister hospital, East Ohio Regional Hospital in Martins Ferry, Ohio are part of the Ohio Valley Health Services and Education Corp. OVHS&E is a family of healthcare hospitals and facilities located throughout the Ohio Valley and is affiliated with Allegheny General Hospital in Pittsburgh, Pennsylvania.

OVMC has an internal medicine residency, rotating internship and family practice residency affiliated with both West Virginia University and West Virginia School of Osteopathic Medicine (also includes emergency medicine). OVMC also has a urology resident -- from WVU and a surgical resident from Allegheny General Hospital. The hospital also supports nursing allied health training programs at several local and regional colleges and universities.

St. Mary's Medical Center, located in Huntington, West Virginia has 393 beds (the second-largest single healthcare facility in West Virginia) serving south and central West Virginia, eastern Kentucky and southern Ohio. St. Mary's has nearly 16,000 admissions annually, with approximately 60,000 ER visits and 158,000 outpatient visits. St. Mary's has Centers of Excellence in Cardiac care, Cancer treatment, Emergency/Level II Trauma services and Neuroscience. As a teaching facility associated with the Joan C. Edwards Marshall University School of Medicine, St. Mary's trains medical residents in several specialties.

The West Virginia United Health System comprises four hospitals in North Central and Eastern West Virginia: West Virginia University Hospitals(WVUH), including Ruby Memorial Hospital, Chestnut Ridge Hospital (Behavioral Medicine), Children's Hospital, and the John Michael Moore Trauma Center in Morgantown;

WVUH-East which includes City Hospital in Martinsburg, and Jefferson Memorial Hospital in Ranson; and United Hospital Center, located in Clarksburg.

WVUHS is a partner with West Virginia University's Robert C. Byrd Health Sciences Center, the largest provider of health care education and research in the state. Ruby Memorial Hospital is the WVUHS tertiary hospital designated as a Level I Trauma Center.

- The system hospitals maintain 1,043 staffed beds.
- The four hospitals in WVUHS treat almost fourteen hundred patients every day.
- Every year WVUHS facilities perform 40,000 surgical procedures, more than 250,000 diagnostic imaging procedures, and a million laboratory tests.
- WVUHS provides a full range of health care services, from family medicine to complex transplant and neurological surgery; from cancer screening to complex Gamma Knife® radiosurgery; from prenatal education classes to comprehensive senior care.
- WVUHS provides a number of post-graduate training programs, including a collaboration with the West Virginia School of Osteopathic Medicine and the Mountain State Osteopathic Postgraduate Training Institute for rotating, family medicine and internal medicine residency programs at Ruby and UHC.

Wheeling Hospital, located in the Northern Panhandle, has 301 beds. The medical and dental staff of 270 represents all specialties. In addition to its primary services, Wheeling Hospital provides laser surgery, cardiac catheterization, kidney dialysis, comprehensive cancer treatment. Services unique to Wheeling Hospital include cardiac surgery, angioplasty, Level-II 24-hour emergency/trauma center, cardiac and pulmonary rehabilitation, kidney dialysis, CT scanner, neuro/vascular laboratory, digital angiography and the hand therapy center. Wheeling Hospital maintains osteopathic (with WVSOM and MSOPTI) and allopathic medical residency programs.

Institutes and Specialty Centers: These organizations, primarily associated with West Virginia University, offer advanced health care services and applied research opportunities. By linking these specialty centers to regional or local health care providers, through the telehealth network, patients throughout West Virginia will benefit from these advances in health care delivery.

The Bianchette Rockefeller Neurosciences institute (BRNI) was created in 1999 and headquartered on the WVU campus, is a world-class basic science and clinical research institute aimed at preventing, diagnosing, treating, and curing neurological, psychiatric, and other cognitive disorders affecting the human brain. The Institute, a collaborative effort between WVU and Johns Hopkins University, was launched by West Virginia's U.S. Senator John D. Rockefeller IV and named after his mother, who died of complications from Alzheimer's disease.

The Rockefeller Institute is dedicated to seeking practical solutions to neurological and cognitive impairment through fundamental neuroscience research, with a special emphasis on Alzheimer's disease and state-of-the-art principles of molecular and cellular neurobiology. In the summer of 2001, Toyota donated \$1 million to the Rockefeller Institute, establishing the Toyota Chair in Advanced Brain Imaging. This gift is expected to attract additional funding and leading researchers in the area of brain imaging to the Institute.

The Sensory Neuroscience Research Center conducts multidisciplinary studies of sensory systems, relating basic research to the solution of disease and disorders. The center has 13 laboratories. Thanks to the Sensory Neuroscience Research Center, the WVU School of Medicine was one of 41 U.S. medical schools to receive a prestigious four-year grant from the Howard Hughes Medical Institute for faculty recruitment in neurosciences and construction of a transgenic rodent facility. SNRC was also awarded an \$8 million NIH grant from the National Center for Research Resources to establish a Center of Biomedical Research Excellence (COBRE) in Sensory Neuroscience to investigate the development and plasticity of sensory systems.

The Mary Babb Randolph Cancer Center (MBRCC) provides research, teaching, and clinical facilities for scientists and physicians working in the areas of cancer treatment, prevention, and cure. The Mary Babb Randolph Cancer Center is West Virginia's most comprehensive cancer treatment, research, and education facility, offering a multidisciplinary approach and state-of-the-art treatment options, as well as access to current clinical trials, a variety of education and prevention outreach programs, and some of the top researchers in the country. All standard treatment approaches—chemotherapy, radiation therapy, and surgery—are available, along with advanced treatments not yet available at many other institutions.

The Cancer Center houses the Cancer Information Service—an NCI-funded national information and education network—and operates the network's toll-free hotline (1-800-4-CANCER). Other Cancer Center facilities include the Betty Puskas Breast Care Center, the Tobacco Research Center, and the WVU Blood and Marrow Transplantation Program—the only program of its kind in West Virginia.

The Center for Advanced Imaging is a 12,000 square-foot research and clinical imaging facility located on the campus of WVU. The Center currently operates a General Electric Advance PET scanner, a General Electric PETtrace cyclotron (with automated modules for the production of ¹⁸F-FDG and ¹²⁵I-methyl-iodide), a General Electric 1.5T Signa LX MR scanner, and a 3T General Electric Research MRI System. The Center for Advanced Imaging is currently undergoing a major expansion that emphasizes human brain mapping using functional MRI (fMRI).

Center for Interdisciplinary Research in Cardiovascular Sciences (CIRCS) permits investigators to strengthen and unite basic, clinical and translational research in cardiovascular health and disease at WVU. A second and equally important mission is to provide first-rate training of pre- and postgraduate students, residents and fellows to produce the next generation of scholars in the cardiovascular sciences and in cardiovascular medicine.

West Virginia's **Large/Urban** Community Hospitals (Secondary) Within West Virginia's metropolitan statistical areas and/or larger rural communities are hospitals that provide an expanded set of services encompassing a range of acute care and specialty care to meet the needs of their communities and patients referred from surrounding rural areas. The following hospitals are located in larger communities and provide a range of general and specialty acute care services:

Beckley Appalachian Regional Hospital
Bluefield Regional Medical Center
Camden Clark Memorial Hospital
City Hospital
Fairmont General Hospital
Logan General Hospital
Monongalia General Hospital
Princeton Community Hospital
Teays Valley Hospital
Raleigh General Hospital
Reynolds Memorial Hospital
St. Francis Hospital
St. Joseph's Hospital-Parkersburg
Thomas Memorial Hospital
United Hospital Center
Weirton Medical Center

West Virginia's Small Rural Hospitals Across 17 rural counties in West Virginia, acute care is provided locally by specially designated hospitals deemed by the Medicare program as essential in order to assure access to rural Medicare beneficiaries. These hospitals are generally classified as "sole community hospitals" or as "critical access hospitals".

Sole Community Hospitals and Medicare Dependent Hospitals: "Sole Community Hospital" is a reimbursement category designed to maintain access to needed health services for Medicare beneficiaries in isolated communities. Medicare provides higher payments to hospitals that are farther than 35 miles from the nearest hospital and meet other criteria designed to establish that they are the community's sole source of care. "Medicare Dependent Hospital" designation is designed to support small rural hospitals with fewer than 100 beds for which Medicare patients make up a significant percentage of days or

discharges. This greater dependence on Medicare may make these hospitals more financially vulnerable to prospective payment, and the designation is designed to reduce this risk.

The following hospitals are designated under either of these two categories:

Jackson General Hospital
Grant Memorial Hospital
Stonewall Jackson Memorial Hospital
Summersville Memorial Hospital
Greenbrier Valley Medical Center
Pleasant Valley Hospital
Davis Memorial Hospital
Wetzel Memorial Hospital
Welch Community Hospital

(St. Joseph's Hospital-Buckhannon and Williamson Memorial Hospital do not qualify for these designations but are small rural hospitals under 100 beds)

Critical Access Hospitals: The Balanced Budget Act of 1997 (Public Law 105-33) established the Medicare Rural Hospital Flexibility Program, a national program designed to assist states and rural communities in improving access to essential health care services through the establishment of limited service hospitals and rural health networks. The program creates the Critical Access Hospital (CAH) as a limited service hospital eligible for Medicare certification and reimbursement and supports the development of rural health networks consisting of CAHs, acute care hospitals, and other health care providers. These facilities are limited to 25 acute care beds and an average 96-hour length of stay.

West Virginia's 18 Critical Access Hospitals fulfill an important healthcare function within their respective communities. Each hospital provides emergency care, primary care, short-term acute care and other ancillary services within and for their respective communities. Several of these hospitals also provide a continuum of long-term care services, including home health, skilled nursing, and hospice. The following hospitals are designated as Critical Access Hospitals:

Boone Memorial Hospital
Braxton County Memorial Hospital
Broaddus Hospital
Grafton City Hospital
Hampshire Memorial Hospital
Jefferson Memorial Hospital
Minnie Hamilton Health Care Center
Montgomery General Hospital
Morgan County War Memorial Hospital
Plateau Medical Center
Pocahontas Memorial Hospital

Potomac Valley Hospital
Preston Memorial Hospital
Richwood Area Community Hospital
Roane General Hospital
Sistersville General Hospital
Summers County ARH Hospital
Webster Memorial Hospital

Specialty and governmental hospitals: West Virginia's hospital system also includes four Veteran's Administration Hospitals in Clarksburg, Huntington, Beckley and Martinsburg. There are three state-owned hospitals: Welch Community Hospital (acute care); Sharpe Hospital and Mildred Bateman Hospital (psychiatric). There are also the following specialty hospitals:

Rehabilitation hospitals: HealthSouth—four hospitals located in Princeton, Huntington, Parkersburg, and Morgantown.

Psychiatric hospitals: Highland Hospital (Charleston) and River Park Hospital (Huntington).

Long-term Acute Care Hospitals: Cornerstone Hospital of Huntington and Select Specialty Caie (Charleston)

Behavioral health facilities: West Virginia has five psychiatric hospitals, 14 behavioral health centers, and 65 certified intermediate care facilities for the mentally retarded (ICF-MR). Two of the psychiatric hospitals (150 beds) are owned and operated by the state (noted above) and two are privately owned and operated (also noted above). In addition, about one-fourth (15) of the community hospitals have psychiatric services. In total, there are slightly more than 500 psychiatric beds statewide, 150 public beds and 357 private beds. The public health system serves between 60,000 and 70,000 persons annually.

Ambulatory surgery centers: Ambulatory surgical services are also provided in nine licensed outpatient surgery centers located outside of acute care hospitals. These facilities are concentrated in the more densely populated areas, principally Charleston, Huntington, and Morgantown. Several are dedicated to ophthalmologic surgery.

Community Health Centers: West Virginia has a large network of primary care centers (also known as "community health centers"). There are 34 nonprofit primary care centers, with 139 primary care service sites (including 34 school-based health centers), providing services in or to 42 counties.. Given the large number of counties without community hospitals and the large number of medically underserved areas, these centers are the principal or only source of basic medical care in many rural communities. These organizations participate in a number of state organizations, including the West Virginia Primary Care

Association and the Community Health Network of West Virginia. Many health centers are also part of vertical networks, such as the Partners in Health Network that operates in coordination with CAMC and the Mid-Ohio Valley Alliance.

Nursing homes and facilities: There are 106 licensed commercial nursing homes statewide. In 1997, these facilities operated a total of 9,944 beds. There are an additional 536 long-term nursing care beds in state-owned public nursing homes, and 1,033 beds in community hospitals that have been converted from acute care use to Medicare skilled nursing home beds. There are a total of 10,791 Medicaid certified beds in all locations statewide. There has been a moratorium on commercial nursing home development for more than a decade, during which the only capacity increases permitted have been the conversion of excess acute care hospital beds to skilled nursing home use.

Personal care: In addition to the commercial, public, and hospital-based nursing home beds, there are 65 licensed personal care homes statewide of four or more beds each. These homes operated a total of 2,443 licensed beds in 1997. As with some nursing home beds, some of the personal care beds are converted hospital beds that are operated as "distinct parts" of acute care community hospitals. There are also 652 licensed personal care beds located in larger residential board and care facilities around the state. Adding all licensed personal care beds brings the total licensed long-term care capacity to 14,608 beds, or about 53 beds per 1,000 persons over 65 years of age.

Other community health organizations: There are also 54 local health departments, 73 home health agencies and 20 hospice organizations providing services in West Virginia.

Physicians and allied health care professionals: As of 2006, there were 3,743 MDs and 507 DOs active and practicing in West Virginia according to the respective licensing boards. Approximately one-third of West Virginia's physicians are self-employed in a solo practice. More than one-third of West Virginia's physicians provide primary care. Other statistics indicate:

- With 184 physicians per 100,000 population, West Virginia was lower than the national ratio of 198 physicians per 100,000. West Virginia ranked 29th among states in physicians per capita.
- West Virginia had 77 active primary care physicians per 100,000 population in 2000, higher than the national rate of 69.
- There were 360 physician assistants practicing in West Virginia in 2000. This is equal to 19.9 physician assistants per 100,000 population, higher than the national rate of 14.4. West Virginia ranked 9th in the nation in physician assistants per capita.
- There were more than 17,700 licensed registered nurses (RNs) in West Virginia in 2000; over 15,500 were employed in nursing. There were 858.9

RNs per 100,000 population in West Virginia in 2000, higher than the national rate of 780.2.

- West Virginia ranked 7th among the states in the per capita employment of Licensed Practical/Vocational Nurses (LPNs), with 363 LPNs per 100,000 population, much higher than the national rate of 240.8 per 100,000. West Virginia ranked 32nd in the number of LPNs employed in 2000 with 6,560 workers.
- There were 540 nurse practitioners in West Virginia in 2000. This was equal to 29.9 nurse practitioners per 100,000 population, below the national rate of 33.7.
- With 55 certified nurse midwives in 2000, West Virginia had 3.0 certified nurse midwives per 100,000 population, comparable to the national rate of 2.9. West Virginia ranked 21st among states in certified nurse midwives per capita.
- With 331 certified registered nurse anesthetists in 2003, West Virginia had 18.3 nurse anesthetists per 100,000 population, almost double the national rate of 9.3. West Virginia had one of the highest ratios of nurse anesthetists per capita in the nation.
- There were 735 dentists, 440 dental hygienists, and 690 dental assistants practicing in West Virginia in 2000. There were 40.7 dentists per 100,000 population in West Virginia in 2000, well below the national rate of 63.6. West Virginia ranked 44th in the nation in dentists per capita. The per capita ratio of dental hygienists was also substantially lower than the national rate.
- There were 1,490 pharmacists and 1,940 pharmacy technicians and aides practicing in West Virginia in 2000. West Virginia had 82.4 pharmacists and 107.3 pharmacy technicians and aides per 100,000 population in 2000, which ranked them 18th and 8th, respectively, among the 50 states.
- There were 127 psychiatrists, 490 psychologists, and 3,850 social workers in West Virginia in 2000. This was equal to 7.0 psychiatrists, 27.1 psychologists, and 213 social workers per 100,000 population. West Virginia ranked 40th among states in psychiatrists per capita, 31st among states in psychologists per capita, and 9th among states in social workers per capita. Source: <http://bhpr.hrsa.gov/healthworkforce/reports/statesummaries/westvirginia.htm>

Health Care Status: The health status of West Virginia is one of the most compelling reasons for this telehealth initiative. In a number of studies, West Virginia ranks near the top of adverse health outcomes and the prevalence of chronic conditions. A number of studies have shown that, of the adult population in West Virginia:

- ◆ 64% are obese or overweight;
- ◆ 32.4% have high blood pressure (with another 28% at-risk with pre-hypertension);
- ◆ 37.5% have high cholesterol;
- ◆ 28.2% are current smokers;
- ◆ 8.8% have diabetes (and another 3% are undiagnosed diabetics) and 40% are pre-diabetic;

- ◆ 24.7% of individuals with a chronic medical condition also suffer from depression or other behavioral conditions:
- ◆ more than 35% of West Virginia adults reported getting no physical activity within the last month and nearly 70% of West Virginians are classified as sedentary; and
- ◆ 85% have one or more risk factors for chronic disease.

These conditions have serious consequences for the affected individuals, their families and employers and place a drain upon the health care delivery system:

Diabetes:

- One in every five dollars billed for hospital care in West Virginia is related to diabetes.
- According to one study, one-third of West Virginians are at risk of developing diabetes during their lifetime.
- According to the CDC, most diabetic patients average 7.9 physician office visits annually. The average for the general population was 3.1 visits per year. A study found that approximately 20% of ER visits for diabetic patients were attributed to preventable complications.
- Improved blood sugar control leading to a 1% reduction in blood sugar levels reduces the risk of developing certain diabetic complications (eye, kidney, and nerve disease) by 40%.
- Regular eye exams and timely treatment could prevent up to 90% of diabetes related blindness.
- For an individual diagnosed with diabetes at age 40, men will lose 11.6 life-years and 18.6 quality-adjusted life years and women 14.3 life-years and 22 quality-adjusted life years. (CDC study reported in JAMA Oct 8, 2003)
- **According to one study, the average lifetime cost of each new case of diabetes is almost \$250,000.**

Cardiovascular disease:

- Eight of every ten hospital discharges in West Virginia during 1998 were related to cardiovascular disease. (Source: Bureau for Public Health, Burden of Cardiovascular Disease in West Virginia)
- Treatment to control blood pressure can reduce heart disease and stroke by 33 to 50% and diabetes-related kidney failure by 33%.
- About 90% of middle-aged West Virginians will develop high blood pressure in their lifetime, and nearly 70% of those who have it now do not have it under control. Lowering blood pressure levels reduces risk of death from coronary heart disease, stroke, and total cardiovascular disease.
- **A recent study places the lifetime cost of each new case of cardiovascular disease at almost \$500,000.**

Depression:

- Studies indicate that depression and anxiety are prevalent in 20 to 25% of the patients served by West Virginia's community health centers. The prevalence rate for depression or other mental condition for patients with a chronic medical condition is 24.7%, nearly 40% higher than for those individuals with no medical condition.

Weight management and physical activity:

- According to a recent study, obesity is responsible for 61% of type 2 diabetes in this country. Obese individuals have a 27 times higher risk of developing diabetes than individuals that maintain a healthy weight. (Source: Bureau for Public Health, Obesity in West Virginia)
- Changes in diet and exercise resulting in the loss of 10-15 pounds can prevent or delay the onset of type 2 diabetes for people at high risk for the disease—those defined as pre-diabetic. In one study, patients walked an average of 30 minutes a day, 5 days a week, and lowered their intake of fat and calories. Their efforts reduced their risk for diabetes by 58%.
- The West Virginia Public Employees Insurance Agency and Medicaid had over \$200 million in obesity-related expenditures in 2001. There is a strong correlation (67%) between an unhealthy weight and diabetes, high blood pressure, hypertension, heart disease, asthma and/or cancer).
- Alarming, nearly 85,000 of our students are overweight or at-risk of becoming overweight. Overweight adolescents have a 70% chance of becoming overweight or obese adults. One in three children born in 2000 is at risk of developing diabetes due to physical inactivity and diet if current trends continue.
- Physical inactivity is a leading contributor to disease and disability, accounting for 22% of colon cancer, 18% of osteoporosis-related fractures, and 12% of diabetes and hypertension.

Asthma:

- Asthma affects almost 100,000 West Virginians with a total direct medical cost of \$43 million. Hospitalization costs for asthma last year exceeded \$12.5 million. The average charge for each hospitalization for asthma complications is over \$5,000. Twenty percent of the people with asthma account for 80% of the health care cost associated with the disease. The annual cost of care for these at-risk asthma patients was \$2,584.00 compared to \$410.00 for other asthma patients.

Tobacco Use:

- Over one-fourth of adults in West Virginia smoke, but, more alarmingly, 39 percent of our teenagers are current smokers (U.S. rate of 28 percent) and approximately 33 percent are daily smokers, addicted before they are adults. The cost to each West Virginian for smoking-related health care costs is **\$500 (nearly \$1.0 billion)**.

Health care utilization: West Virginia has experienced these adverse health outcomes despite spending over \$10 billion on health care. The utilization of health care services falls within the following categories:

Health Care Spending in West Virginia (in millions)

	WV	WV	US	US
	\$	%	\$	%
Hospital Care	4,074	40.2	566,886	36.5
Physician & Other Professional Services	2,605	25.7	446,349	28.8
Prescription Drugs	1,475	14.6	189,651	12.2
Nursing Home Care	682	6.7	115,015	7.4
Dental Services	334	3.3	81,476	5.3
Home Health Care	191	1.9	42,710	2.8
Other Medical Nondurables	152	1.5	32,761	2.1
Medical Durables	116	1.1	23,128	1.5
Other Personal Health Care	494	4.9	53,278	3.4
Total	10,124	100	1,551,255	100

Source: Kaiser Foundation-State Health Facts

The utilization of inpatient hospital services was as follows according to the West Virginia Health Care Authority 2006 Annual Report:

Discharges by Payor Class:

Medicare	147,624
Medicaid	52,125
PEIA	11,493
Other Gov't.	7,470
Non-Gov't.	74,381
Total	293,093

According to the West Virginia Health Care Authority 2006 annual report, there were nearly 3.8 million hospital outpatient encounters and almost 1.0 million emergency room visits in 2006 (nearly twice the national average per capita). Nursing home utilization was 3.3 million total patient days for FY 2005.

According to the National Ambulatory Medical Care Survey, the average number of physician encounters is 3.4 per person, with 1.3 of these being primary care

visits. Applying these ratios to West Virginia, there were over 6 million physician encounters last year and over 2 million of these were for primary care services.

According to the West Virginia Primary Care Association, 292,849 patients (accounting for over 1 million encounters) were served by Federally Qualified Health Centers (Primary Care Centers) in West Virginia during 2005.

Opportunity for enhancement **of** service through telehealth applications: Even with these extensive and high quality health care resources, gaps in care and health disparities continue to exist. As noted above, a large number *of* underinsured and underserved citizens continue to reside in several rural areas throughout West Virginia. Increased access to preventive, primary, and specialty care for citizens in these underserved areas through telehealth applications will permit timely care to avoid many of the deadly and costly complications of unmanaged or undetected chronic or serious illnesses.

Several studies have shown that access to these types of services can reduce the inappropriate use of emergency rooms for routine care and avoidable hospitalizations (resulting in higher health care costs for all through cost-shifting) and promote healthier students and workers, thereby enhancing the potential for economic development and growth in these often economically depressed areas.

There is also a need for better coordinated emergency preparedness and response. In light of emergent public health threats related to bioterrorism and homeland security, influenza pandemics, and natural disasters, our citizens expect responses to emergencies to be rapid, timely and effective, even in remote or rural areas.

A large number of West Virginians must contend daily with physical, emotional, and cognitive disabilities. Those who have limitations on daily activities, including those with mental health and substance abuse problems, those who are aging in place, and those who are could benefit from home health monitoring, will place increasing demands on an already strained health care delivery system and use of telehealth applications can avoid or delay institutionalization of these individuals, resulting in a better quality of life in community-based, less restrictive settings and help families meet the needs of these individuals in a compassionate and sensitive fashion.

With an aging population, the demand for a wide continuum of health and social services may swamp the existing delivery system without the application of these telehealth technologies. Access to the most appropriate level of healthcare, regardless of geographic barriers or travel distance, can address four areas of concern for this burgeoning population:

Objectives and Guiding Principles:

Under this Strategic Plan, a broad array of health care professionals and organizations, government agencies, telecommunications providers, supporting organizations and interested parties will establish a dedicated advanced communication and information infrastructure, including access to Internet 2 linkages for research and integrated health improvement education and coordination, to promote and enhance telehealth applications within West Virginia and to connect these participants with collaborating parties throughout the country and the world. The statewide telehealth network, as developed by the participants in this network, is intended to be accessible within every region, health care market and community in West Virginia, with particular focus on rural medically underserved rural areas (MUAs); health professional shortage areas (HPSAs); communities with high disease and chronic health condition disparities; and communities that demonstrate a "readiness for deployment".

The network will utilize, to the greatest extent commercially practical existing telecommunication infrastructure established by telephone, cable, cellular, microwave, and satellite communications companies. To supplement the existing capabilities of the telecommunications infrastructure, the network will coordinate linkage of major hubs within the existing telehealth network and the build-out of advanced communication and information infrastructure where needed to complete or enhance the intended network capabilities. The network will provide members with the capability to disseminate health education information, provide clinical consultations by employing video and/or image and/or telephone conferencing, and employ home health monitoring with any other member of the network. The initial network participants have designated the following guiding principles as key attributes of the desired advanced communication and information infrastructure. The plan will have the following attributes:

- High speed bandwidth:
Allowing for simultaneous voice, video, imaging and data sessions;
- Cost Effective:
Utilizing modern telecommunication technology and existing wire, fiber optic and wireless telecommunications circuits;
- Ease of Use
Using standard off the shelf equipment including PCs, hand-held personal assistant (PDA) and other equipment;
- Manageable
Using a coordinated decentralized management structure to coordinate the exchange and interoperability of a diverse group of participants using different technology applications;
- Reliable
Using quality equipment with high operational availability rates, and telecommunication lines and systems that assure a high quality of service and up-time;

- Dependable
Using multiple paths both on the backbone and access to remote communities where possible;
- Scalable
Allowing for flexibility of design to handle small, large, and growing areas to connect participants within West Virginia and to other parties both within and outside the state;
- Interoperable
Using standards based equipment and protocols with common definition and meeting agreed interoperability standards;
- Accessible
It will facilitate telehealth use over a dedicated network through direct connection, virtual private network, the public Internet or, dial-up connections;
- Sustainable
Funds to sustain the network will be sufficient to continue activities after grant funds or appropriations expire;
- Secure
The network will use appropriate commercially reasonable security encryption and other privacy protection measures meeting HIPAA and other applicable standards.

The goal of the plan is first and foremost to improve the health of West Virginians. While this plan contemplates the use of telehealth technology as a tool, the technology is only a tool (albeit an important one). To be successful, this plan requires a blend of state of the art technology with common sense collaboration and equal measures of mutual respect and trust. It must employ a people-first approach. It seeks to promote and encourage:

- The further development of a statewide telehealth network infrastructure to enhance healthcare delivery with priority emphasis placed on rural medically underserved regions using telehealth/telemedicine technologies.
- Increased access to health care and supporting services while containing or decreasing healthcare costs.
- The dissemination of relevant information, training, and technical assistance to healthcare organizations and providers to assist them with the adoption, deployment and utilization of new and emerging telehealth technologies for patient treatment and care coordination.
- Increased use of distance learning in public health and medical care.
- Access to training for healthcare workers, medical professionals, and patient education in rural and medically underserved areas.
- Connection of the telehealth network to facilitate interfaces with regional and national telehealth initiatives.

Implementation of Plan:

The initial participants in the Alliance have adopted the following steps for implementation of this plan:

1. Establish the West Virginia Telehealth Alliance, Inc. (WVTA) as a 501(c)(3) tax-exempt nonprofit West Virginia corporation to implement and coordinate the activities contemplated by this Strategic Plan:
 - WVTA will have two sub-groups, one focused on infrastructure development and technical standards and one focused on telehealth applications and utilization. A board of participants will govern the organization and activities of WVTA will be coordinated with the West Virginia Health Information Network.
2. Utilize existing telecommunications infrastructure to connect major participants (hubs) and then to connect rural participants on a regional basis, starting in southern West Virginia and then proceeding north and east to affect a phased integration and coordination of advanced communication and information infrastructure that supports telehealth applications.
 - Coordinate the existing activities of MDTV, CAMC, Marshall University, the West Virginia School of Osteopathic Medicine, the participating members of the West Virginia Hospital Association and the Community Health Network of West Virginia, the West Virginia Primary Care Association, First Choice network and participating community mental health centers, free clinics, local health departments, state-operated facilities and other health care providers through a dedicated network utilizing a scalable high-speed broadband infrastructure. Identify gaps in service and access as part of a review of services during the first 12 months of operation.
3. Develop the WVTA as a self-sustaining organization promoting a flexible, scalable, secure, and cost-effective network infrastructure capable of electronically linking all communities through telehealth applications within West Virginia.
 - WVTA or its designee will seek funding under the FCC Pilot Initiative and from state appropriations, private foundations and other sources to supplement member contributions and assessments to complete the initial build-out, deployment and enhancement of the network, including the requisite studies of gaps in the system and the cost of connecting participants to high-speed services and will recruit a sufficient number of participants to assure that WVTA is self-sustaining after the expiration of such grant or FCC funds

4. Provide rural hospitals, clinics, medical practices, mental health, and social services providers the technical assistance to effectively utilize appropriate telehealth applications and, at least annually, convene a meeting of participants and interested parties to exchange telehealth best-practices; to coordinate and enhance greater utilization of telehealth applications; and make any necessary modifications to this plan.
 - WVTA will develop recommendations for state and federal sources of funding to help reduce the barriers to entry for those who seek to participate in the telehealth network.

The WVTA will measure successful progress toward the implementation of the Strategic Plan by using the following benchmarks and outcome measures:

Outcomes	<i>Performance measures</i>
1. Sustained coordination and collaboration among telehealth users	# of participating telehealth sites and # of
2. Advancement of telehealth education/training	# of health care providers or other clinicians trained using telehealth or distance learning through network linkages and # of educational programs available through network telehealth resources
3. Collaborate on securing additional funds to advance telehealth systems and use in West Virginia	% of funding increase over 2006 baseline for telehealth services and increase from baseline year in services available and # of participants through network telehealth applications

The project plan will proceed with the following activities and mileposts:

Phase/Activity	Start Date	End Date
1. Convene stakeholders and participants quarterly with at least one workshop focused on telehealth coordination and expansion	5/1/07	Continuing
2. Establish and organize WTHA as 501(c)(3)	5/1/07	12/31/07
3. Establish web-site clearinghouse for telehealth activities	7/1/07	12/31/07
4. Evaluate telehealth network and planning for expansion	7/1/07	Continuing

5. Connection of hubs and interconnection of telehealth infrastructure as contemplated in strategic plan and FCC grant application	7/1/07	Continuing
6. Offer health improvement, education and training programs via telehealth network	5/1/07	Continuing

Education, Research and Assessment

The use of telehealth and distance learning technology to deliver health information and training and to facilitate research in remote areas is an important tool in a coordinated health improvement effort. For underserved and remote communities, telehealth offers the promise of reducing the constraints imposed by distance and poor infrastructure while improving health and well-being. The project contemplated by this plan has, as its primary focus, health improvement through use of these technologies. This section outlines the educational and research objectives and how the effectiveness of the project will be evaluated and assessed to assure that these objectives are met.

Medical knowledge and skills essential for tomorrow's healthcare professionals continue to change faster than ever before creating new educational and research demands. New methods to enhance learning by coupling innovations in clinical education with advanced technology in high performance computing and next generation Internet2 embedded in virtual reality environments, artificial intelligence and experiential active learning. Simulations have been used in education and training to allow learners to make mistakes safely in lieu of real-life situations, learn from those mistakes and ultimately improve performance by subsequent avoidance of those mistakes. Distributed virtual interactive environments are used over distance to enable learning and participation in dynamic, problem-based, clinical, artificial intelligence rules-based, virtual simulations. The virtual reality patient is programmed to dynamically change over time and respond to the manipulations by the learner.

Bringing people together as virtual teams for interactive experiential learning and collaborative training, independent of distance, provides a platform for distributed "just-in-time" training, performance assessment and credentialing. Further validation is necessary to determine the potential value of the distributed virtual environments in knowledge transfer, improved future performance and should entail training participants to competence in using these tools.

The three educational institutions that have associated Medical or Osteopathic programs, Marshall University, West Virginia University and the West Virginia School of Osteopathic Medicine, have active programs for distributed education and research utilizing broadband technologies. West Virginia University is currently the only institution in the state with Internet2 access and is only available in Northern West Virginia. Marshall University utilizes Metropolitan Ethernet contracts from a variety of vendors including Verizon, FiberNet and nTelos. OARnet, the networking division of the Ohio Supercomputer Center, will serve as the Internet2 network partner of Marshall University. OARNet is completing a southern loop between Athens and Portsmouth, Ohio via Huntington, West Virginia. This connection is within several blocks of the Marshall University Huntington campus and provides us an opportunity to integrate the Marshall and